

Claims (amended)

1. Device for producing a breaker ply having a longitudinal axis, a breaker ply length and mutually parallel cords at a pre-set cord angle to the longitudinal axis, wherein the device comprises:

- an extrusion device for producing at least one continuous rubber strip having substantially mutually parallel embedded longitudinal cords having a centre-to-centre distance and having a strip width;
 - a first transport device for transporting the continuous rubber strip in the direction of the longitudinal cords;
 - a second transport device for transporting the breaker ply in the longitudinal direction of the breaker ply in a transport direction, comprising a support surface for the breaker ply;
 - a cutting device for cutting bands from the continuous strip diagonally at the cord angle;
 - a building drum for receiving the breaker ply coming from the second transport device, wherein the building drum has an axis of rotation,
- wherein the first transport device is adapted for transporting the continuous strip to the second transport device, the second transport device is positioned with its transport direction at an angle having the size of a cord angle to the direction of the longitudinal cords, the longitudinal direction of the breaker ply substantially corresponds to the transport direction, and the building drum is positioned with its axis of rotation substantially transverse to the second transport direction, wherein the second transport device is provided with a first drive and a first operator for operating the first drive, wherein the operator is adapted for controlling the drive for adjustably moving the support surface of the second transport device with an adjustable

transfer distance for positioning the next band, or a transport distance for transporting the breaker ply towards the building drum.

2. Device according to claim 1, wherein the operator comprises a memory for the strip width, the centre-to-centre distance between the longitudinal cords and the breaker ply length and a calculating unit for calculating a band number, being the necessary number of bands to form a breaker ply, and the transfer distance from the centre-to-centre distance, the strip width and the breaker ply length.
3. device according to claim 2, wherein said transfer distance is calculated for each breaker ply again.
4. Device according to claim 3, wherein the operator comprises a counter for counting the number of bands placed, and a decision routine for deciding to transport the breaker ply to the building drum when the number of bands placed equals the band number, or when the breaker ply length has been reached.
5. Device according to any one of the preceding claims, further comprising a measuring unit for measuring the length of the breaker ply on the support surface of the second transport device during making the breaker ply, connected to the operator.
6. Device according to claim 2-5, wherein the operator is adapted for adjusting the transfer distance based on the measured length of the breaker ply during manufacturing it, the set breaker ply length and the set centre-to-centre distance between the longitudinal cords.
7. Device according to any one of the preceding claims, wherein the first transport device furthermore comprises a placement device for picking up the continuous rubber strip or bands from the first transport device and placing it

or them on the support surface of the second transport device.

5 8. Device according to claim 7, wherein the placement device is positioned after the cutting device for placing the continuous rubber strip on the support surface.

9. Device according to claim 7 or 8, wherein the placement device is provided with a splicer for splicing the bands together into a breaker ply.

10 10. Device according to any one of the preceding claims, wherein the second transport device comprises a transfer device for transferring the support surface to the building drum for placing the breaker ply against the building drum.

15 11. Device according to any one of the preceding claims, wherein the second transport device comprises a first conveyor and a second conveyor, wherein the conveyors are positioned with their transport directions in line, wherein the first conveyor comprises a support surface for receiving the bands or continuous rubber strip and a drive connected to the operator.

20 12. Device according to claim 11, wherein the second conveyor comprises a support surface for supporting the breaker ply, wherein the support surface of the second conveyor is movable from a first position, in which the support surface of the first conveyor lies in line with the support surface of the
25 second conveyor, to a second position, in which the support surface rests against the building drum.

30 13. Assembly for manufacturing a breaker for a tyre, comprising two devices according to any one of the preceding claims for almost simultaneously manufacturing two breaker plies, wherein the second transport devices of the devices for manufacturing a breaker ply, with their transport directions are positioned substantially parallel to each other.

14. Assembly according to claim 13, wherein the building drums of the first and second device for manufacturing a breaker ply, with their axes of rotation are positioned substantially in line, and are mounted on a common building drum holder so as to be jointly rotatable about an axis substantially perpendicular to the axis of rotation.

15. Assembly according to claim 13 or 14, wherein the extrusion devices of both devices for manufacturing a breaker ply, with their extrusion devices are positioned substantially parallel to each other.

16. Assembly according to any one of the claims 13-15, wherein the second transport devices of both devices for manufacturing a breaker ply each comprise a support surface for supporting and transferring a breaker ply, wherein both support surfaces are movable to the building drums of the respective devices for manufacturing a breaker ply, wherein one support surface is movable to the upper side of the building drum for arranging a front side of a breaker ply on the upper side of the building drum, and the other support surface is movable to the lower side of the other building drum for arranging the front side of a breaker ply on the lower side of said building drum.

17. Device according to any one of the preceding claims 1-12, furthermore comprising a third transport device, having its transport direction substantially parallel to the transport direction of the second transport device, and a second cutting device for cutting the continuous rubber strip substantially parallel to the first cutting device.

18. Device according to claim 17, wherein the second cutting device is arranged for cutting between the second and third transport device.

19. Device according to claim 17 or 18, wherein the third conveyor

comprises a support surface for a breaker ply, situated adjacent to and consecutive to the support surface of the second conveyor.

20. Device according to any one of the preceding claims, furthermore provided with a main operation device, wherein the main operation device comprises a memory and a data processing unit, an input unit for setting the centre-to-centre distance between the longitudinal cords and a breaker ply length and software for reading a set centre-to-centre distance between the longitudinal cords and the breaker ply length.

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21. Device according to claim 20, wherein the software is provided with a distance routine for calculating the target mutual distance between the bands from the band width, the centre-to-centre distance between the longitudinal cords and the set breaker ply length.

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22. Device according to claim 21, wherein the software is furthermore provided with operation routines for operating the placement device for transferring a partly formed breaker ply, wherein the transfer is calculated by means of the distance routine for calculating the mutual distance between the bands.

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23. Method for producing a breaker ply having a longitudinal axis, a breaker ply length and mutually parallel cords at a pre-set cord angle to the longitudinal axis, wherein a continuous rubber strip provided with substantially parallel longitudinal cords, a set strip width and set centre-to-centre distance between the longitudinal cords one to the other, is produced in the longitudinal direction by means of an extrusion process, the continuous rubber strip is cut into bands at the cord angle, a predetermined number of bands with cords substantially parallel and adjacent to each other at a set band distance with respect to each other for forming a breaker ply having a pre-set breaker ply length are placed on a support surface, wherein the mutual distance of the bands is calculated to obtain a set length of the

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breaker ply, when the breaker ply has reached the target breaker ply length the breaker ply is transported in longitudinal direction to a building drum, and is wound on the building drum, wherein a predetermined mutual centre-to-centre distance of the cords and the width of the continuous strip is set, the
5 length of the breaker ply is measured during manufacturing, and the mutual distance of the bands is each time adjusted for realising a pre-set breaker ply length, wherein the adjustment of the mutual distance at the most is the centre-to-centre distance of the cords, preferably at the most 20% of the centre-to-centre distance.

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24. Method according to claim 24, wherein the centre-to-centre distance and the target length of the breaker ply is entered into a computer provided with operation software, wherein the operation software calculates the distance between the bands.

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25. Method according to claim 25, wherein the operation software regulates the transfer of an already formed part of the breaker ply.

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26. Method for building a breaker ply, wherein a continuous rubber strip provided with cords is produced in the longitudinal direction by means of an extrusion process, the continuous strip is cut into bands at a cord angle, the bands are placed adjacent to each other on a support surface the cords one to the other being almost parallel and at a mutual band distance in order for several bands together to form a breaker ply having a pre-set length, the
25 breaker ply on the support surface is transported to a building drum and is wound onto the building drum, wherein the mutual band distance is determined once again for each band of the breaker ply.

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27. Method according to claim 26, wherein the building drum after arranging a first breaker ply is rotated about an axis perpendicular to the axis of rotation of said building drum.

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28. Method according to claim 27, wherein the building drum is rotated in the horizontal plane.

5 29. Method according to claim 27 or 28, wherein a second breaker ply is arranged over the first breaker ply, wherein the cords of the first and second breaker ply are crossed with respect to each other.

10 30. Method according to claim 29, wherein the first and second breaker ply are supplied to the building drum with the cord angle in the same direction, wherein the one breaker ply is secured at the upper side of the building drum and is wound around the building drum in a first winding direction, and the other breaker ply is secured at the lower side of the building drum and is wound around the building drum counter to the first winding direction.

15 31. Device for almost simultaneously producing at least two breaker plies for a belt, wherein each breaker ply has a longitudinal axis, a breaker ply length and mutually parallel cords at a pre-set cord angle to the longitudinal axis, wherein the device comprises:

- 20 - an extrusion device for producing at least one continuous rubber strip having substantially mutually parallel embedded longitudinal cords having a centre-to-centre distance and having a strip width;
- at least two cutting devices for diagonally at a cord angle cutting bands from the continuous strip along a cutting line, wherein the cutting devices are positioned with their cutting lines practically parallel;
- 25 - at least one strip transport device for transporting the continuous rubber strip substantially in the direction of the longitudinal cords;
- a second and third transport device, each for transporting a breaker ply substantially in the longitudinal direction of the breaker ply in a transport direction, each comprising a support surface for the breaker ply, and positioned with their transport directions substantially parallel;
- 30 - at least one building drum having an axis of rotation, for receiving a

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breaker ply coming from the second transport device and a breaker ply coming from the third transport device,

wherein the strip transport device is adapted for transporting the continuous strip to the second and third transport device, the second and third transport device are positioned with their transport direction at an angle the size of the cord angle to the direction of the longitudinal cords, the longitudinal direction of the breaker plies substantially corresponds to the transport direction, and the building drum with its axis of rotation is positioned substantially transverse to the second and third transport direction.

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32. Device according to claim 31, wherein the extrusion device is adapted for simultaneously producing at least two rubber strips.

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33. Device according to claim 31 or 32, wherein the second and third transport device are positioned above one another, preferably with their support surfaces practically parallel.

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34. Device according to claim 31-33, wherein the device is furthermore provided with an operator connected to the drive of the second transport device and the drive of the third transport device, the cutting devices and the building drum for the.

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35. Device according to claims 31-34, wherein the one transport device is positioned with below and the other above the axis of rotation of the building drum or building drums.

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36. Device according to claims 31-35, furthermore comprising at least two placement devices, each for picking up bands from the first transport device and transferring and placing them in the longitudinal direction of the cords on the second and third transport device, respectively.

37. Device according to claim 31-36, wherein the second and third transport

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device each are provided with a placement device to transfer at least a part of the transport device in turns to a building drum to arrange a breaker ply against the building drum.

- 5 38. Device according to claims 31-37, comprising two strip transport devices, having their transport directions mutually substantially parallel.

39. Device comprising one or more of the characterising measures described in the description and/or shown in the drawings.

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40. Method comprising one or more of the characterising measures described in the description and/or shown in the drawings.

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